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Summary of the 1991 Coho Salmon Smolt Trapping Operations on the Lachmach River, British Columbia

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SUMMARY OF THE 1991 COHO SALMON SMOLT TRAPPING OPERATIONS ON THE LACHMACH RIVER, BRITISH COLUMBIA

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ABSTRACT

Davies, D. L. W., B. O. Finnegan, and L. B. Holtby. 1992. Summary of the 1991 coho salmon smolt trapping operations on the Lachmach River, British Columbia. Can. Data Rep. Fish. Aquatic. Sci. 871: 61 p.

A permanent smolt fence was used to capture coho smolts at the mouth of the Lachmach River, east of Prince Rupert, British Columbia, between April 21 and June 30, 1991. In total, 14,572 coho smolts were captured. Of these, 13,469 smolts were coded wire tagged and adipose fin clipped and 3,642 smolts were sampled for fork length. Totals of 1,001 coho fry, 855 rainbow trout, 1,506 Dolly Varden charr, 738 sculpins and 5 cutthroat trout were also captured at the fence.

Two 2x3 inclined plane traps were used to capture fish in the river close to the fence. The two traps caught combined totals of 2,395 coho smolts, 3,047 coho fry, 3,539 pink fry, 6 chum fry, 90 rainbow trout juveniles, 31 Dolly Varden charr juveniles and 114 sculpins.

RÉSUMÉ

Davies, D. L. W., B. O. Finnegan, and L. B. Holtby. 1992. Summary of the 1991 coho salmon smolt trapping operations on the Lachmach River, British Columbia. Can. Data Rep. Fish. Aquatic. Sci. 871: 61 p.

Une barrière permanente à l'embouchure de la rivière Lachmach, à l'est de Prince Rupert (Colombie-Britannique), a permis de capturer 14,572 tacons coho entre le 21 avril et le 30 juin 1991. De ceux-ci, 13,469 on été marqués d'une micro-marque magnétisée codée et ont eu la nageoire adipeuse coupée; on a également mesuré la longueur à la fourche de 3,642 d'entre eux. La barrière a également permis de capturer 1,001 alevins de coho, 855 truites arc-en-ciel, 1,506 Dolly Varden, 738 chabots et 5 truites fardées.

On a utilisé deux trappes inclinées de 2 pi sur 3 pi pour capturer des poissons dans la rivière, près de la barrière. Ces trappes ont permis de capturer 2,395 tacons coho, 3,047 alevins de coho, 3,539 alevins de saumon rose, 6 alevins de kéta, 90 jeunes truites arc-en-ciel, 31 jeunes Dolly Varden et 114 chabots.

INTRODUCTION

The Lachmach River Project is part of the Coho Salmon Research Program which was initiated in response to the Canada-U.S. Pacific Salmon Treaty. The Program obtains information on the biology and productivity of coho salmon (Oncorhynchus kisutch) stocks in British Columbia. The Lachmach River Project was set up in the spring of 1987 to obtain information on coho salmon stocks in northern British Columbia. Data have been collected each spring beginning in 1987, (Table 1; Finnegan 1990; Finnegan et al. 1990; Davies 1991a,b).

The Lachmach River is located 23 km east of Prince Rupert, B.C., at the head of Work Channel (Fig. 1). It is a small coastal stream approximately 8 km in length. It drains a small (41.3 km^2) catchment bordered by steep mountains. Clearcut logging occurred on the western slope of the catchment in the late 1970's and early 1980's. The river is characterised by a low gradient reach in the lower 2 km, a passable falls 2 km from the mouth and mixed low gradient and riverine pond reaches in the upper 6 km (Fig. 2). Populations of coho salmon (Oncorhynchus kisutch), pink salmon (O. gorbuscha), chum salmon (O. keta), steelhead trout (O. mykiss), cutthroat trout (O. clarki clarki), Dolly Varden charr (Salvelinus malma), freshwater sculpins (Cottus sp.) and three spined sticklebacks (Gasterosteus aculeatus) are present in the river. This report presents data from fence operations, coho smolt sampling and coded wire tagging and inclined plane trap operations during the spring of 1991.

METHODS

The smolt fence used on the Lachmach River in 1991 was modified slightly from the one used in previous years (Finnegan 1990). The fence is a permanent design and is constructed of welded aluminum. The trap boxes were rebuilt in 1991 and made one foot narrower (4'x3'x3'). Small mesh screens (1/8") were stapled to the side openings to retain fry. On June 15, baffles were installed in the boxes with 1/4" mesh screen attached to the openings to separate fry from smolts.

Two 2x3 inclined plane traps (Conlin and Tutty 1979) were used in the Lachmach River in 1991 to both collect data on fish that were small enough to swim through the fence, (mostly coho and pink fry), and to compare nightly catches with the fence. One trap was located 50 m upstream of the fence in the same location as the trap in 1990. The other trap was located

300 m upstream of the fence. Each trap was tethered by a 1/4 inch cable to another 1/4 inch cable spanning the river. Every evening, the traps were pushed into the main flow of the river and left to fish overnight. Every morning the traps were emptied of fish, cleaned and pulled to the side of the river, out of fishing position, for the remainder of the day.

The fish captured in the each of the traps were counted and sampled separately from the fish caught at the fence. All fish from the upper IPT were counted and sampled for fork length and released on site. Fish caught in the lower IPT were brought downstream to the fence site and counted. Coho smolts were then combined with smolts caught at the fence and coded wire tagged.

Every day at the fence, fish were collected from the traps into large pails, sorted by species, counted and checked for marks. Sub-samples of coho smolts were obtained by rapidly moving a small dipnet through the pail of fish and scooping fish into another pail until 100 fish or about 10% of the total catch was removed. Fish selected for sampling were anaesthetized with 2-phenoxyethanol and measured for fork length and weight. Fork lengths were measured on a smolt board to an accuracy of 1.0 mm. Weights were measured on an Acculab portable balance to an accuracy of 0.1 g. Selection for scale sampling for age analysis was done by selecting smolts in 5 mm size groups from 40 mm to 170 mm and attempting to get 25 scale samples from each group with equal sampling throughout the smolt run. Both fin samples and otoliths were taken from all dead coho smolts for age analysis. Fish with fin clips or any unusual condition (ie. deformities, injuries, etc.) were recorded. All clipped and unusually large or small fish (whether within the random sample or not) were measured for length and weight and had scales taken. Coho fry were anaesthetized and their fork lengths were measured and recorded. All other species of fish were anaesthetized, measured for fork length and wet weight and then released. Mortalities were recorded by species, measured for fork length and wet weight. Coho mortalities had scale, otolith and fin samples taken for age analysis.

Coho smolts captured at the main fence were coded-wire tagged. Fish were anaesthetized with 2-phenoxyethanol, adipose fin clipped and coded wire tagged with standard tags (Northwest Marine Technologies, Shaw Island, WA.; Mk II Tagging Unit). Coho smolts were divided into two groups, larger and smaller than 85.5 mm, and were tagged with different tag codes. This size was selected as the best length to separate age 1.0 and 2.0 smolts based on age-length analysis in 1989 (Davies, 1990). Age 3.0 smolts were tagged with the same code as age 2.0 smolts. Coho juveniles released untagged and unclipped included fish smaller than 55 mm, which were too small to tag, and damaged or moribund fish. Tag codes for large coho were 08/08/01 and 08/09/09. The tag code for small coho was 08/08/05.

During each day of tagging, a maximum of 100 tagged fish from each size group were held overnight. The next day these fish were put through the metal detector of the quality control device to see which fish had lost their tags. After subtracting mortalities, the number of fish with retained tags were divided by the number of fish held to obtain a tag retention estimate for each day and each tag code. All fish that had lost their tags were retagged before release.

Two groups of one hundred smolts were coded-wire tagged, adipose clipped and marked (upper or lower caudal clip) and released 50 m upstream of the main fence to assess the fence's capture efficiency. Recaptures of marked fish were recorded at the main fence and the recapture rate was used as an indication of fence efficiency. The first group, consisting of 25 small and 75 large smolts with an upper caudal clip, were released on May 10. The second group consisting of 50 smolts of each size group with a lower caudal clip, were released on May 18. On June 20, 155 coho fry that had been dyed in a bath of Bismark Brown solution for 2 hours, were released 500 m upstream of the fence.

Adult steelhead were counted through the fence either by dipnetting them from the trap or from behind the fence nosecones and passing them over the top of the fence or by opening a gap in the fence panels and letting them swim through.

Fence maintenance consisted of periodic cleaning of the screened panels, throat nets and trap boxes. Periodic underwater visual inspections, using snorkels and drysuits, were conducted especially after freshets to check for fence integrity. During freshets when water levels threatened to top the fence, upper panels from the middle of the fence were removed to prevent damage to the fence.

Daily records were kept of cloud cover, precipitation, water temperature and maximum and minimum air temperature. Observations were generally taken at the fence site at 0800.

RESULTS

FENCE

The Lachmach River fence was in operation from April 21 until June 30 (71 days) in 1991. It was operated for about three weeks longer than in previous years. On two occasions, freshets forced field staff to remove fence panels to prevent damage to

the fence. On May 11, fence panels were removed at noon and were not replaced until May 12 at 1600. On June 9 panels were removed at 1400 and not replaced until 1500 on June 11.

Coho Smolts

In total, 14,572 coho smolts were counted migrating downstream past the Lachmach River counting fence in 1991 (Table 2). Up to 2,000 smolts may have passed uncounted, downstream through the fence during the flood of May 11 and 12. This is rough estimate based on the observations of smolt outmigration during similar freshets when the fence did fish. In total, 13,469 smolts or 92.4% of the total run were coded wire tagged, 714 died during capture or tagging operations and 389 were released untagged. Of the tagged smolts, 11,524 (85.6%) were classed as large smolts and 1,945 (14.4%) were classed as small smolts (Table 3). Tag retention data are presented in Table 4. If 24 hour tag loss results are applied to all the tagged smolts, then 1,997 smolts would retain tag code 08/09/09, 9,044 smolts would retain tag code 08/08/01 and 1,909 smolts would be expected to retain tag code 08/08/05.

Fork lengths were taken from 3,642 coho smolts (25.0%) and 3,395 (23.3%) smolt weights were measured (Table 5). The mean fork length and wet weight of coho smolts captured at the fence (>55 mm) was 94.9 mm $\pm$ 0.2 mm and 8.01 g $\pm$ 0.05 g. Juvenile coho length frequencies are presented in Figure 3.

Totals of 485 scale samples, 107 otolith samples and 108 fin samples were taken from coho smolts for age analysis. Of these, 62 scale samples could not be aged due to scale regeneration or poor samples, 143 were analyzed as age 1.0, 194 as age 2.0 and 86 as age 3.0 (Table 6). For fish in which more than one structure was taken for age analysis, there was almost total agreement in age determination between the structures. As in previous years, uncertainty about what constituted an annulus on scales from fish near the upper and lower size limits for each age reduced the confidence level for aging certain fish.

The mean lengths of age 1.0, 2.0 and 3.0 smolts were 76.1 mm $\pm$ 0.92 mm, 106.0 mm $\pm$ 0.98 mm and 127.5 mm $\pm$ 1.24 mm respectively (Table 6). The length frequency histogram (Fig. 4) for aged smolts shows that age 1.0 and age 2.0 smolts overlap between 75 mm and 105 mm and that age 2.0 and age 3.0 smolts have a large overlap between 100 mm and 130 mm.

An estimate of the age composition of coho smolts was obtained by first calculating the proportion of each age within each 1 mm length class. Then each proportion was multiplied by the total number of smolts within each length class to get the total number of smolts by age in each class. These numbers were

then summed by age over all to obtain the number of smolts by age for the entire coho smolt run. These results showed that 1,223 (33.3%) were age 1.0, 2,208 (60.1%) were age 2.0 and 240 (6.5%) were age 3.0.

The coho smolt run started to increase in the first two weeks of May, and to peak on May 25 with secondary peaks on May 20, May 24 and May 31 (Fig. 5). The run was declining during the first week of June, and very low numbers were being caught throughout June.

Two fence efficiency tests were conducted using coho smolts (Table 7). Of the 75 large and 25 small smolts released 50 m upstream of the fence on May 10, only 15 large and 7 small smolts were recaptured at the fence. The low recapture rate for this test is probably due to the fact that the fence was out during the freshet of May 11. The second test was done on May 18, when 50 large and 50 small smolts were released 50 m upstream of the fence. All of the large smolts and 29 of the small smolts were recaptured resulting in a recapture rate of 79%. These results indicate a high efficiency if one takes into account the fact that marked fish released upstream of the fence do not necessarily migrate downstream during fence operations and that released fish may experience some handling and stress related mortality.

A number of smolts with mutilation type marks were recovered at the fence (Table 8). Most of these fish were marked in 1989 in the course of population estimate studies using mark and recapture methods. A total of 17 of the 19 adipose fin clipped fish were killed and sampled for scales, otoliths and fins. Coded wire tags were recovered and read from 16 of these smolts. All of them were fish tagged in 1991 and all were recovered between May 20 and May 31. These fish probably swam upstream of the fence during the flood event of May 11 and May 12 when the fence panels were removed.

Coho Fry

The large number of emergent coho fry caught in 1991 probably reflects a change in fishing patterns and methods compared to previous years. In 1991 the fence was kept fishing almost one month longer than in previous years and for the first time, two inclined plane traps were used instead of one.

Coho fry captured at the fence totalled 1,001 (Table 9) and the mean fork length was 34.5 mm $\pm$ 0.1 mm (Table 10). The coho fry run appeared to start in early June, peak in the latter half of June and decline in the first half of July, although there were still fry being caught when the inclined plane traps were removed on July 13 (Fig. 5,6,7).

On June 15, baffles with large openings covered with 1/4" aluminum mesh were installed in the fence trap boxes. Coho fry were small enough to swim through the mesh into the rear compartment and thus escape predation by the larger fish trapped in the front compartment. Before June 15, the low numbers of coho fry captured at the fence, in part, reflects predation in the trap boxes.

A combined fence / inclined plane trap efficiency test was conducted with coho fry (Table 7). A total of 155 coho fry dyed with Bismark Brown were released on June 20 approximately 500 metres upstream of the fence. Dyed fry recaptures totalled 32 with 17 caught in the upper IPT, 6 caught in the lower IPT and 9 caught at the fence.

Other Species

Totals of 855 rainbow / steelhead trout (Oncorhynchus mykiss) juveniles and 1,506 Dolly Varden charr (Salvelinus malma) juveniles were captured. In total, 738 scuplins were captured, including 319 Cottus asper, 380 Cottus aleuticus and 39 unidentified cottids. In addition, 1,424 pink fry (O. gorbuscha), and 5 cutthroat trout (O. clarki) juveniles were captured at the fence (Table 11).

Juvenile rainbow trout were migrating in low numbers in April and the first half of May (Fig. 8). They increased in the third week of May and peaked at the end of May. Rainbow trout numbers were high, but declined throughout June and early July. Dolly Varden charr were being caught in low numbers when the fence was installed in mid April. They increased in number throughout May and reached a peak in the last week of May. Dolly Varden charr numbers rapidly declined in the first half of June and ended by mid June. Sculpins were caught as soon as the fence was installed and increased to a peak in the first week in May. They slowly decreased throughout the study period and were still being caught in low numbers when the fence was taken out on June 30. Steelhead adults were trapped moving both upstream and downstream but too few were counted to accurately establish run timing. Low numbers of upstream migrating steelhead were seen passing the fence from mid April to late May. Steelhead kelts were seen first in early June with an observed peak in the second week of June. Few kelts were seen after June 12.

Sampling data from fish other than coho smolts are presented in Tables 12, 13, 14, and 15. Length frequencies of rainbow trout, Dolly Varden charr, and sculpins are presented in Figures 9, 10, and 11 respectively.

We counted 65 steelhead adults migrating upstream and 186 steelhead kelts going downstream. Upstream migrants had

ample opportunity to pass the fence uncounted before the fence the fence was installed and during the freshet periods when the fence panels were removed. Many downstream migrating kelts probably passed the fence uncounted. Fence panels were removed during the June 10 freshet when kelt numbers appeared to be peaking.

INCLINED PLANE TRAPS

The upper inclined plane trap (IPT) was fishing for a total of 69 nights between April 26 and July 13. The lower IPT was fishing for a total of 79 nights between April 18 and July 13. Both traps were pulled out of fishing position on the nights of May 12, May 31, June 10, June 19, and July 1 to July 3 due to high water conditions.

The catches of all fish species in the inclined plane traps varied considerably on a daily basis from fence captures. The numbers of fish in the inclined plane trap boxes depended on such factors as the variation in water flow, trap depth and position of the trap in relation to the main current.

When compared to fence captures, the IPTs also appeared to selectively capture smaller fish. Fish larger than about 105 mm were apparently able to either swim out of the traps or avoid them altogether. It also appears that fish more associated with the stream bottom, such as sculpins and Dolly Varden charr, were not caught as effectively in the IPTs. Smaller sculpins and Dolly Varden charr which were captured at the fence were not captured in the IPTs.

When the traps were checked each morning, the fishing efficiency was visually evaluated by observing the amount of water passing over the hinged aluminum lip. If no water was flowing over the lip or if water was flowing over the whole trap, the IPT was said to be fishing poorly.

Coho Smolts

In total, 980 coho smolts were captured in the lower trap (Table 16) and 1,415 smolt were captured in the upper trap (Table 17). The mean fork length of coho larger than 55 mm from the lower trap was 94.2 mm $\pm$ 0.4 mm and from the upper trap was 93.6 mm $\pm$ 0.4 mm (Table 18). The mean fork lengths of smolts captured in the traps were less than the mean fork length of smolts caught at the fence. This may reflect the fact that larger smolts were able to swim out of the trap throats and thus escape before being caught in the boxes.

The timing of the coho smolt run as recorded at the fence and the IPT's roughly correspond in terms of start, peak and end (Fig. 5,6,7). Comparison of smolt captures at the fence and in the IPTs on a daily basis show high variability. This is probably due to the variability of trapping effectiveness of the IPTs.

Coho Fry

Totals of 1,214 and 1,833 coho were captured in the lower and upper inclined plane traps (IPT's) respectively (Table 9). Fork lengths of coho fry ranged from 31 mm to 39 mm with a mean of 34.4 mm $\pm$ 0.1 mm (Table 10, Fig. 3).

Other species

The lower inclined plane trap caught 2,763 pink fry, 1 chum fry, 15 rainbow trout, 10 Dolly Varden charr, and 44 sculpins (Table 16). The upper inclined plane trap caught totals of 776 pink fry, 5 chum fry, 75 rainbow trout, 21 Dolly Varden charr, and 70 sculpins (Table 17).

Both inclined plane traps caught far fewer rainbow trout, Dolly Varden charr and sculpins than the fence. This may reflect the fact that these species were generally large enough to swim out of the inclined plane traps and avoid being caught.

Pink fry numbers were high when the lower trap was installed on April 18. The pink fry run appeared to continue during the remainder of April and decrease in the first week of May (Table 16 and Table 17).

Too few chum fry were captured to comment on run timing, but the 6 that were caught in the IPTs were all caught in the third week in June. A total of 67 trout fry were caught in the upper IPT just before the traps were pulled out in mid July (Table 17).

ENVIRONMENTAL DATA

Precipitation at the Lachmach River fence in 1991 was characterised by periodic heavy rain associated with storm fronts (Fig. 12). The maximum recorded precipitation of 54 mm fell on June 10. Total precipitation for the period of April 15 to July 13 was 341 mm. Maximum and minimum air temperatures varied from a low of -2.0°C on April 15,18 and May 3 to a high of 34°C on June

21 (Fig. 13). Water temperatures varied from a low of 3°C from April 17 to April 22 to a high of 15°C on July 10 (Fig. 14).

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REFERENCES

Conlin, K. and B. D. Tutty. 1979. Juvenile salmonid field trapping manual. Fisheries and Marine Service MS Rep. 1530: 135 p.

Davies, D. L. W. 1990. Summary of 1989 coho salmon smolt trapping operations on the Lachmach River, British Columbia. Can. Data Rep. Fish. Aquat. Sci. 831: 37 p.

Davies, D. L. W. 1991. Summary of 1990 coho salmon smolt trapping operations on the Lachmach River, British Columbia. Can. Data Rep. Fish Aquat. Sci. 832: 53 p.

Finnegan, B. O. 1990. Summary of 1988 coho salmon smolt trapping operations on the Lachmach River, British Columbia. Can. Data Rep. Fish. Aquat. Sci. 844: 29 p.

Finnegan, B. O., R. L. Dunbrack, and K. Simpson. 1990. Summary of 1987 coho salmon smolt trapping operations on the Lachmach River, British Columbia. Can. Data Rep. Fish Aquat. Sci. 812: 27 p.

Table 1. Historical summary of fish capture and tagging during the spring at the Lachmach River.

		Coho Smolts			Other Species		
Year	Fence Type	Total	CWT	RBT	D.V.	Cottids	Coho Fry
1987[a]	temp.	1,909	1,790	5	13	97	17
1988[b]	perm.	9,983	9,192	103	351	175	0
1989[c]	perm.	21,410	19,482	1,176	1,592	767	0
1990[c]	perm.	25,860	24,639	1,189	1,964	1,387	52
1991	perm.	14,572	13,469	855	1,506	738	1,001

[a]In 1987, a temporary, wooden smolt fence was used which frequently washed out resulting in an incomplete count of the number of migrating fish.

[b]In 1988, a permanent, aluminum fence was installed, but it is believed that it was not completely fish tight resulting in a low count of migrating fish.

[c]In 1989, 1990 and 1991 the same permanent fence was used and we believe that the numbers of fish captured accurately reflect the true numbers of fish migrating.

cwt = coded wire tagged; temp. = Temporary;
perm. = Permanent; rbt = rainbow/steelhead trout juvenile;
D.V. = Dolly Varden charr

Table 2. Daily captures and coded wire tagging summaries of coho smolts from the main fence on the Lachmach River, 1991.

Date	Total Smolts Through the Fence	Dead Smolts	Total Smolts Released Untagged	Total Smolts Released Tagged
Apr. 19	2	0	2	0
Apr. 20	1	0	1	0
Apr. 21	2	0	2	0
Apr. 22	9	5	0	4
Apr. 23	8	2	0	6
Apr. 24	6	2	0	4
Apr. 25	10	1	0	9
Apr. 26	7	2	0	5
Apr. 27	9	4	0	5
Apr. 28	13	1	0	12
Apr. 29	32	8	0	24
Apr. 30	22	1	0	21
May 1	24	0	0	24
May 2	70	4	0	66
May 3	94	7	0	87
May 4	171	20	0	151
May 5	161	18	4	139
May 6	105	13	2	90
May 7	156	7	5	144
May 8	92	3	0	89
May 9	155	3	6	146
May 10	138	7	0	131
May 11	205	10	20	175
May 12	122	13	2	107
May 13	483	45	23	415
May 14	508	26	11	471
May 15	165	2	0	163
May 16	208	3	9	196
May 17	367	10	9	348
May 18	726	75	29	622
May 19	312	7	23	282
May 20	1,130	218	53	859
May 21	346	36	14	296
May 22	612	4	11	597
May 23	568	4	4	560
May 24	1,120	8	12	1,100
May 25	1,894	17	34	1,843
May 26	719	5	16	698
May 27	293	3	6	284
May 28	310	8	9	293
May 29	359	35	13	311
May 30	391	4	5	382

Table 2 (cont'd)

Date	Total Smolts Through the Fence	Dead Smolts	Total Smolts Released Untagged	Total Smolts Released Tagged
May 31	1,330	32	12	1,286
June 1	269	17	4	248
June 2	83	1	0	82
June 3	139	0	1	138
June 4	238	3	2	233
June 5	96	9	4	83
June 6	45	1	2	42
June 7	78	3	4	71
June 8	16	0	0	16
June 9	48	4	1	43
June 11	6	0	1	5
June 12	11	0	0	11
June 13	9	0	0	9
June 14	5	0	0	5
June 15	4	0	0	4
June 16	6	0	1	5
June 17	8	0	0	8
June 18	7	0	1	6
June 19	6	1	4	1
June 20	16	2	0	14
June 21	3	0	3	0
June 22	4	0	4	0
June 23	0	0	0	0
June 24	6	0	6	0
June 25	0	0	0	0
June 26	10	0	10	0
June 27	0	0	0	0
June 28	2	0	2	0
June 29	0	0	0	0
June 30	2	0	2	0
Totals	14,572	714	389	13,469

Table 3. Daily coded wire tagging summary

Date	No. Tagged and Released			% Tag Retention	
	Small	Large	Total	Small	Large
Apr. 19	0	0			
Apr. 20	0	0	0		
Apr. 21	0	0	0		
Apr. 22	0	4	4	100	
Apr. 23	3	3	6	67	100
Apr. 24	1	3	4		
Apr. 25	4	5	9	100	100
Apr. 26	1	4	5	100	100
Apr. 27	2	3	5	100	100
Apr. 28	2	10	12	100	90
Apr. 29	9	15	24	100	100
Apr. 30	5	16	21	100	100
May 1	7	17	24	100	100
May 2	14	52	66	100	98
May 3	24	63	87	92	100
May 4	42	109	151	100	99
May 5	16	123	139	100	100
May 6	20	70	90	100	99
May 7	31	113	144	87	100
May 8	17	72	89	100	96
May 9	27	119	146	93	99
May 10	32	99	131	100	100
May 11	35	140	175	100	100
May 12	20	87	107	90	100
May 13	70	345	415	90	98
May 14	120	351	471	100	100
May 15	45	118	163	93	96
May 16	43	153	196	98	100
May 17	62	286	348	100	100
May 18	86	536	622	100	100
May 19	27	255	282	100	99
May 20	85	774	859	98	97
May 21	42	254	296	100	90
May 22	68	529	597	100	98
May 23	55	505	560	100	99
May 24	84	1,016	1,100	100	95
May 25	132	1,711	1,843	100	95
May 26	59	639	698	100	100
May 27	39	245	284	100	99
May 28	25	268	293	100	97
May 29	36	275	311	100	96
May 30	76	306	382	100	98

Table 3 (cont'd)

Date	No. Tagged and Released			% Tag Retention	
	Small	Large	Total	Small	Large
May 31	191	1,095	1,286	94	96
June 1	61	187	248	100	98
June 2	29	53	82		
June 3	33	105	138	100	100
June 4	51	182	233	96	100
June 5	14	69	83	100	100
June 6	12	30	42	94	100
June 7	15	56	71	100	98
June 8	6	10	16	100	100
June 9	22	21	43	100	100
June 11	3	2	5	100	100
June 12	4	7	11	100	100
June 13	5	4	9	100	100
June 14	4	1	5	100	100
June 15	4	0	4	100	
June 16	5	0	5	100	
June 17	3	5	8		100
June 18	5	1	6		
June 19	1	0	1		
June 20	11	3	14	100	100
Totals	1,945	11,524	13,469	98%	99%

Table 4. Coded wire tagging summary by tag code.

Tag Code	Smolt Size	Tagging Dates	Total Tagged and Released	% Tag Retention
08-09-09	large	Apr. 22 - May 17	2,219	99.0
08-08-01	large	May 17 - June 20	9,305	97.2
08-08-05	small	Apr. 22 - June 20	1,945	98.1
		Totals	13,469	98.0

Table 5. Summary of coho smolt sampling data from the Lachmach River fence, spring 1991. Data are from fish larger than 55 mm.

Date	Fork Length (mm)			Wt Weight (g)		
	N	Mean	SE	N	Mean	SE
Apr. 22	9	91.8	3.90	9	7.37	1.10
Apr. 23	8	84.5	2.51	8	5.79	0.44
Apr. 24	6	85.3	4.91	6	6.06	0.99
Apr. 25	10	87.8	2.42	9	6.22	0.55
Apr. 26	6	85.3	1.77	6	5.64	0.48
Apr. 27	9	91.1	4.92	9	7.31	1.30
Apr. 28	9	102.4	2.97	8	10.51	1.00
Apr. 29	32	96.8	2.18	31	8.84	0.64
Apr. 30	21	95.3	1.97	21	8.13	0.48
May 1	22	94.8	2.22	21	8.21	0.54
May 2	63	95.9	1.56	63	8.25	0.42
May 3	83	94.9	1.26	83	7.95	0.31
May 4	74	93.4	1.38	50	7.84	0.50
May 5	100	95.6	0.96	77	7.88	0.28
May 6	85	92.3	1.00	50	7.02	0.29
May 7	109	92.8	1.04	55	7.29	0.48
May 8	92	94.6	1.23	92	8.01	0.33
May 9	144	93.3	0.94	75	7.31	0.36
May 10	100	91.2	1.08	76	7.02	0.28
May 11	100	93.4	1.18	100	7.46	0.30
May 12	100	95.1	1.08	100	8.04	0.28
May 13	100	93.4	1.12	100	7.59	0.28
May 14	100	96.8	1.49	99	8.68	0.44
May 15	50	92.5	1.62	49	7.33	0.37
May 16	75	96.6	1.37	75	8.31	0.36
May 17	101	96.7	1.26	101	8.36	0.35
May 18	100	101.3	1.32	100	9.61	0.36
May 19	99	96.1	1.03	99	8.04	0.27
May 20	100	98.4	1.09	100	8.83	0.29
May 21	100	97.4	1.10	100	8.43	0.30
May 22	100	95.8	1.26	100	8.23	0.34
May 23	100	99.9	1.07	100	9.10	0.27
May 24	100	103.7	1.30	100	10.29	0.37
May 25	100	99.4	1.18	100	8.96	0.30
May 26	100	99.8	1.20	98	9.33	0.33
May 27	50	97.3	1.66	50	8.52	0.44
May 28	75	95.7	1.22	75	8.13	0.30
May 29	75	98.5	1.35	75	8.73	0.33
May 30	75	94.5	1.20	75	7.75	0.29
May 31	100	95.0	1.08	100	7.95	0.26
June 1	100	92.2	1.07	100	7.55	0.28

Table 5 (cont'd)

Date	Fork Length (mm)			Wet Weight (g)		
	N	Mean	SE	N	Mean	SE
June 2	83	90.8	1.04	78	7.07	0.26
June 3	100	95.1	1.22	100	8.01	0.31
June 4	100	93.3	1.04	100	7.32	0.25
June 5	92	94.1	1.15	90	7.65	0.33
June 6	45	91.2	1.57	45	7.20	0.38
June 7	78	92.3	1.11	78	7.27	0.29
June 8	15	92.7	3.27	15	7.40	0.91
June 9	48	86.9	1.47	46	6.18	0.37
June 11	6	83.8	7.28	5	6.14	1.72
June 12	11	87.1	3.42	11	6.31	0.65
June 13	9	81.1	3.74	9	5.03	0.67
June 14	3	87.7	12.51	3	7.90	3.27
June 15	3	76.7	4.12	3	4.20	0.52
June 16	6	77.0	4.38	6	4.12	0.58
June 17	7	81.7	5.36	7	5.36	0.74
June 18	7	79.9	2.84	7	5.33	0.68
June 19	6	77.5	4.34	6	4.98	0.71
June 20	13	76.7	1.95	13	4.33	0.41
June 21	3	77.0	3.30	3	4.40	0.55
June 22	4	75.2	1.63	4	4.63	0.49
June 23	0			0		
June 24	7	75.3	1.59	7	4.16	0.28
June 25	0		0			
June 26	10	75.8	3.45	10	4.83	0.80
June 27	0			0		
June 28	2	77.0	0.71	2	4.50	0.05
June 29	0			0		
June 30	2	86.5	7.42	2	6.95	1.17
Totals	3,642			3,395		
Means		94.9			8.01	
Overall SE			0.20			0.05

Table 6. Summary of Lachmach River coho smolt sampling data for aged fish, 1991.

Age	Length (mm) N	Mean	S.E.	Weight (g) N	Mean	S.E.
1	143	76.1	0.92	128	4.36	0.19
2	194	106.0	0.98	164	11.36	0.32
3	86	127.5	1.24	74	19.08	0.48
Total	423			366		

Table 7. Summary of recaptures used to estimate fence efficiency on the Lachmach River, 1991.

Date	Recaptures		
	Upper Caudal/ Adipose Smolts	Lower Caudal/ Adipose Smolts	Bismark Brown Dyed Fry
May 10	100 released		
May 11	19		
May 12	1		
May 14	1		
May 17	1		
May 18		100 released	
May 19		7	
May 20		17	
May 21		6	
May 22		7	
May 23		1	
May 24		13	
May 25		23	
May 26		4	
May 29		1	
June 20			155 released
June 23			7 (u. IPT)
June 23			2 (l. IPT)
June 25			1 (l. IPT)
June 25			5 (fence)
June 26			6 (u. IPT)
June 27			4 (u. IPT)
June 28			4 (fence)
June 30			3 (l. IPT)
Total Recaptures	22	79	32

Table 8. Summary of marked smolts captured at the fence on the Lachmach River, 1991.

Mark	Location Marked	Date Marked	Total No. Marked	No. Recaptured
Adipose	Fence	Apr.-June/91	14,572	19
Lower Caudal*				8
Upper Caudal*				10
Left Ventral	3820 m	Sept. 9,11/89	696	3
Right Ventral	5000 m	Aug. 21/89	897	2
Left Maxillary	Fence	June 6 - 16/89	109	6
Right Max.	7000 m	Sept. 14/89	286	13
Left Max./ Left Vent.	2600 m	Sept. 4,18/89	322	2
Right Max./ Right Vent.	4500 m	Sept. 7/89	356	3
Left Max./ Right Vent.	500 m	June 29,30/89 Sept 3/89	136	2
Right Max./ Left Vent.	2000 m	June 26/89 Aug. 1/89	224	3

* Juvenile coho were marked with upper and lower caudal fin clips in various locations on various dates throughout 1989 and 1990. Coho marked in this way were used for local mark and recapture operations and will be described in future reports.

Table 9. Daily captures of coho fry from the fence and the upper and lower inclined plane traps (IPT's) on the Lachmach River, 1991. Fry are defined as coho juveniles smaller than 60 mm.

Date	Fence	Lower IPT	Upper IPT
May 19	0	0	1
May 23	0	1	2
May 25	0	0[P]	1
May 26	0	0	2[P]
May 27	0	0	1
June 1	0	1[P]	3[P]
June 2	0	1[P]	4[P]
June 3	0	1	3
June 4	1	0	5
June 5	0	1[P]	3
June 6	0[P]	0	13
June 7	2	0[P]	10[P]
June 8	0	3	47
June 9	4[P]	54[P]	93[P]
June 10	[a]	22[P]	[a]
June 11	13	37	11[P]
June 12	0	2[P]	29
June 13	1	36	40
June 14	0	55	82
June 15	1	52	2[P]
June 16	23	45	64
June 17	52	40	6
June 18	38	39	120[P]
June 19	134	67	[a]
June 20	79	96	106
June 21	79	0[P]	0[P]
June 22	11	51	42
June 23	52	76	176
June 24	23	83	76
June 25	24	127	135
June 26	158	156	114
June 27	47	0[P]	119
June 28	108	4[P]	128
June 29	43	49	186
June 30	108	57	17[P]
July 1	[a]	3[P]	[a]
July 4	[a]	6[P]	12
July 5	[a]	20[P]	70
July 6	[a]	19	10[P]
July 7	[a]	4	9
July 8	[a]	1	7
July 9	[a]	1	0

Table 9 (cont'd)

Date	Fence	Lower IPT	Upper IPT
July 10	[a]	1	21
July 11	[a]	0	59
July 12	[a]	3	0
July 13	[a]	0	4[b]
Totals	1,001	1,214	1,833

[b]denotes trap or fence fishing poorly

[a]denotes trap or fence not fishing

Table 10. Summary of coho fry sampling data from the fence and the upper and lower inclined plane traps (IPT's) on the Lachmach River, 1991. Data are from fish smaller than 60 millimetres.

Date	Fence			Lower IPT			Upper IPT		
	N	f.l. (mm)	SE	N	f.l. (mm)	SE	N	f.l. (mm)	SE
May 19							1	35.0	
May 23				1	37.0		2	36.0	1.41
May 25							1	33.0	
May 26							2	36.5	0.35
May 27							1	34.0	
June 1				1	36.0		2	36.0	0.71
June 2				1	34.0		1	38.0	0.00
June 3				1	34.0		3	35.0	0.48
June 4	1	35.0					3	34.0	0.48
June 5				1	33.0		3	36.0	0.48
June 6							13	34.2	0.29
June 7	2	35.5	1.06				9	34.4	0.36
June 8				3	34.3	0.47	47	34.5	0.19
June 9	4	34.7	0.65	54	35.4	0.20	37	35.3	0.15
June 10				22	34.7	0.17			
June 11	13	35.1	0.21	35	34.0	0.20	10	34.6	0.35
June 12				2	33.5	0.35	19	35.7	0.33
June 13	1	32.0		36	34.9	0.24	28	34.8	0.21
June 14				28	35.4	0.30	71	34.6	0.19
June 15				41	34.6	0.19	2	34.0	0.71
June 16	23	35.0	0.31	26	34.3	0.22	34	34.5	0.25
June 17	30	35.0	0.31	40	34.5	0.25	6	34.2	0.44
June 18	23	35.3	0.30	36	34.7	0.24	28	34.0	0.30
June 19				25	34.2	0.24			
June 20	25	33.8	0.27	25	34.1	0.24	25	33.5	0.28
June 21	25	34.7	0.34						
June 22	11	35.2	0.54	25	34.7	0.27	25	33.9	0.33

Table 10 (cont'd)

Date	Fence			Lower IPT			Upper IPT		
	N	f.l. (mm)	SE	N	f.l. (mm)	SE	N	f.l. (mm)	SE
June 23	40	34.0	0.33	25	33.6	0.30	32	33.9	0.26
June 24	23	35.1	0.34	31	34.4	0.20	25	33.9	0.36
June 25	23	35.0	0.33	27	34.2	0.36	24	33.8	0.34
June 26	29	33.8	0.28	26	34.6	0.31	25	33.7	0.33
June 27	25	34.0	0.31				29	33.4	0.38
June 28	28	34.6	0.28	4	34.2	0.41	24	34.5	0.42
June 29	34	34.1	0.27	28	34.4	0.25	32	33.6	0.24
June 30	31	34.4	0.28	27	34.0	0.25	17	33.8	0.50
July 4				6	33.7	0.56	12	34.5	0.45
July 5				20	34.1	0.27	70	33.5	0.17
July 6				18	34.4	0.38			
July 7				4	35.0	0.35	9	34.2	0.81
July 8				1	34.0		7	34.7	0.52
July 9				1	36.0				
July 10				1	38.0		15	33.7	0.47
July 11							14	32.7	0.41
July 12				3	0.54				
July 13							4	35.2	0.65
Totals	390			625			712		
Means		34.5			34.5			34.2	
Overall SE			0.08			0.06			0.06

Table 11. Daily captures of fish other than coho smolts at the main fence, Lachmach River, 1991.

Date	Rainbow Trout	Dolly Varden	*Cottus asper*	*Cottus aleuticus*	*Cottus* sp.	Coho Fry	Pink Fry	Cutt. Trout	Adult Steelhead	
									Up	Down
Apr. 18	1				4		186		1	
Apr. 19	2						250			
Apr. 20				1			122			
Apr. 21					1		250			
Apr. 22	1	13	10	1			293		1	
Apr. 23		19	5	1			274			
Apr. 24	1	6	2	3			39			
Apr. 25		9		2						
Apr. 26		1	2	1					5	
Apr. 27	3	3	4	5						
Apr. 28		2	6	6						
Apr. 29		2	14	6	13				5	
Apr. 30			10	6	10				4	
May 1	2	8	6	4					6	
May 2	1	16	10	9						
May 3		8	1	44			10		1	
May 4	1	24	16	29				1		
May 5	4	12	13	28	1				1	
May 6	2	8	2	15	1					
May 7	2	11	21	10	1			1		
May 8	2	11	2	8						
May 9	1	9	5	3						
May 10	1	8	3	2					15	
May 11		33	34	7						
May 12		3	10	14					1	
May 13		19	4	11					2	
May 14	1	15	10	11						

Table 11 (cont'd)

Date	Rainbow Trout	Dolly Varden	Cottus asper	Cottus aleuticus	Cottus sp.	Coho Fry	Pink Fry	Cutt. Trout	Adult Steelhead	
									Up	Down
May 15	1	7	7	7					4	
May 16	2	8	8	11						
May 17		24	6	1					2	
May 18	2	29	2	2					1	
May 19	2	31	15	6	1					
May 20	6	19	16	4						
May 21	3	17	14	1						
May 22	3	23	1	1						
May 23	5	21	1	2						
May 24	13	69	6	5					1	
May 25	9	154	8	4				2	1	
May 26	12	62	1	2						
May 27	5	18	2	6					1	
May 28	7	40	1	3					1	
May 29	12	35	7	1					1	
May 30	20	30	3	3						
May 31	39	251			6				6	1
June 1	32	48	9	13						5
June 2	11	32	3	5						
June 3	35	68		2				1		
June 4	69	136	2	2		1				
June 5	40	9	1	5					5	12
June 6	41	33	2	4						150
June 7	70	68	1	5		2				
June 8	24	6		4						
June 9	46	9	1	2		4				
June 11	3	2	2			13				

Table 11 (cont'd)

Date	Rainbow Trout	Dolly Varden	*Cottus asper*	*Cottus aleuticus*	*Cottus* sp.	Coho Fry	Pink Fry	Cutt. Trout	Adult Steelhead	
									Up	Down
June 12	9		3	7						
June 13	39	1	1	4		1				
June 14	25	2		1						6
June 15	26	1	1	1		1				
June 16	19	2		1		23				
June 17	19	2	3	8		52				
June 18	13		1			38				1
June 19	7			1		134				
June 20	38			8		79				
June 21	13					79				1
June 22	53	1		1		11				
June 23	2					52				
June 24	7	2		5		23				
June 25	14					24				
June 26	7			9		158				
June 27						47				
June 28	11	4	1	2		108				
June 29	4					43				
June 30	10	2	1	4		108				
July 4	2									
Totals	**855**	**1,506**	**319**	**380**	**39**	**1,001**	**1,424**	**5**	**65**	**186**

Table 12. Mean fork lengths (mm), sample sizes and standard errors from salmonids other than coho at the fence, Lachmach River, 1991.

Date	Rainbow Trout N	Rainbow Trout Mean FL (mm)	Rainbow Trout SE	Dolly Varden N	Dolly Varden Mean FL (mm)	Dolly Varden SE	Cutthroat Trout N	Cutthroat Trout Mean FL (mm)	Cutthroat Trout SE
Apr. 22	1	141.0		12	256.8	7.43			
Apr. 23				19	248.1	6.02			
Apr. 24	1	79.0		6	225.0	25.70			
Apr. 25				9	234.6	2.80			
Apr. 26				1	248.0				
Apr. 27	3	87.7	12.33	2	280.5	15.91			
Apr. 28				2	215.5	3.18			
Apr. 29				2	157.0	51.62			
Apr. 30									
May 1	2	138.0	0.71	8	255.2	6.59			
May 2	1	117.0		16	223.6	11.76			
May 3				8	236.6	12.85			
May 4	1	136.0		24	198.7	10.63	1	69.0	
May 5	4	114.7	22.81	12	226.0	16.35			
May 6	2	97.5	28.64	8	162.9	14.20			
May 7	2	137.0	1.41	11	198.4	24.09	1	71.0	
May 8	2	154.5	8.84	11	167.0	17.17			
May 9	1	60.0		9	145.1	16.52			
May 10	1	124.0		8	126.6	7.61			
May 11				27	174.3	10.07			
May 12				3	145.3	18.64			
May 13				19	151.5	10.85			
May 14	1	144.0		15	138.0	8.72			
May 15	1	143.0		7	119.1	4.09			
May 16	2	162.5	7.42	8	129.6	13.38			
May 17				24	140.0	7.18			

Table 12 (cont'd)

Date	Rainbow Trout N	Rainbow Trout Mean FL (mm)	Rainbow Trout SE	Dolly Varden N	Dolly Varden Mean FL (mm)	Dolly Varden SE	Cutthroat Trout N	Cutthroat Trout Mean FL (mm)	Cutthroat Trout SE
May 18	2	94.0	24.75	29	125.3	3.71			
May 19	2	126.5	13.79	31	155.5	7.00			
May 20	6	139.2	9.58	19	129.4	5.38			
May 21	3	140.0	2.45	17	127.9	3.88			
May 22	3	154.0	19.60	23	127.3	3.08			
May 23	5	141.0	16.78	21	142.5	8.38			
May 24	13	151.0	11.71	39	152.1	6.15			
May 25				1	310.0		2	282.5	1.77
May 26	12	141.8	10.46	62	138.7	5.31			
May 27	5	115.6	9.07	18	129.3	5.16			
May 28	7	131.1	7.42	40	124.9	1.54			
May 29	12	164.5	2.86	35	130.4	4.28			
May 30	20	149.9	7.55	30	125.9	1.97			
June 1	32	145.1	2.42	48	132.5	2.76			
June 2	11	156.6	6.74	32	136.6	3.78			
June 3	35	156.0	3.23	68	130.0	2.07	1	145.0	
June 4	69	156.3	2.57	136	134.3	1.39			
June 5	40	157.1	3.13	9	131.3	3.18			
June 6	41	150.8	3.39	33	131.4	1.85			
June 7	54	152.7	3.34	54	134.2	3.48			
June 8	24	147.5	3.70	6	127.8	4.71			
June 9	46	143.0	3.35	9	136.4	7.68			
June 11	3	160.0	2.05	1	134.0				
June 12	9	119.1	11.28						
June 13	38	143.1	3.56	1	121.0				
June 14	25	141.4	3.94	2	182.0	22.63			
June 15	26	142.4	4.24	1	98.0				
June 16	19	145.2	3.97	2	134.0	4.95			
June 17	19	150.4	5.19	2	128.5	7.42			

Table 12 (cont'd)

Date	Rainbow Trout N	Rainbow Trout Mean FL (mm)	Rainbow Trout SE	Dolly Varden N	Dolly Varden Mean FL (mm)	Dolly Varden SE	Cutthroat Trout N	Cutthroat Trout Mean FL (mm)	Cutthroat Trout SE
June 18	13	116.2	6.76						
June 19	7	126.7	12.27						
June 20	38	118.4	4.04						
June 21	13	123.9	7.04						
June 22	53	128.6	3.18	1	135.0				
June 23	2	145.5	13.79						
June 24	7	120.7	9.63	2	96.5	4.60			
June 25	14	116.1	6.58						
June 26	7	126.1	11.99						
June 27									
June 28	11	111.7	4.76	4	108.5	9.08			
June 29	4	126.2	5.49						
June 30	10	103.0	4.14	2	84.5	1.06			
July 3	2	91.0	3.53						
Totals	787			1,049			5		
Overall mean		141.3			147.8			170.0	
Overall SE			1.00			1.38			42.87

Table 13. Mean fork lengths (mm), sample sizes and standard errors from cottids at the fence, Lachmach River, 1991.

Date	*Cottus aleuticus*			*Cottus asper*			*Cottus* sp.[a]		
	N	Mean FL (mm)	SE	N	Mean FL (mm)	SE	N	Mean FL (mm)	SE
Apr. 22	1	73.0		10	115.7	5.86			
Apr. 23	1	93.0		5	118.8	5.82			
Apr. 24	3	124.3	1.90	2	117.0	7.07			
Apr. 25	2	105.5	9.55						
Apr. 26	1	91.0		2	119.0	4.24			
Apr. 27	5	94.6	3.72	4	116.0	12.77			
Apr. 28	6	97.7	4.90	6	122.8	2.14			
Apr. 29	6	95.0	6.18	14	118.0	3.44			
Apr. 30	6	84.2	8.43	10	113.6	9.44			
May 1	4	105.5	16.40	6	119.5	2.26			
May 2	9	114.3	3.44	10	113.0	2.77			
May 3	44	121.7	3.24	1	101.0				
May 4	29	112.5	4.83	16	126.9	7.47			
May 5	20	118.5	5.29	11	104.5	4.20	1	99.0	
May 6	15	116.1	5.92	2	106.0	4.95	1	75.0	
May 7	10	100.2	5.87	21	123.7	4.41	1	90.0	
May 8	8	104.5	5.31	2	110.5	2.47			
May 9	3	105.7	8.76	5	115.8	6.78			
May 10	2	128.0	14.85	3	120.3	3.81			
May 11	7	86.3	7.51	15	112.7	3.85			
May 12	14	110.6	4.83	10	114.7	4.60			
May 13	11	104.4	4.00	4	117.5	4.69			
May 14	11	108.4	4.73	10	107.4	4.33			
May 15	7	109.3	1.91	7	104.4	8.65			
May 16	11	122.2	3.43	8	111.2	4.02			
May 17	1	131.0		6	107.3	7.41			
May 18	2	99.5	18.74	2	119.0	5.66			

Table 13 (cont'd)

Date	Cottus aleuticus N	Mean FL (mm)	SE	Cottus asper N	Mean FL (mm)	SE	Cottus sp.' N	Mean FL (mm)	SE
May 19	6	75.2	5.42	15	116.6	4.82	1	55.0	
May 20	4	110.0	8.04	16	114.7	2.13			
May 21	1	101.0		14	109.9	3.37			
May 22	1	69.0		1	111.0				
May 23	2	102.0	4.95	1	119.0				
May 24	5	101.6	10.04	6	100.7	5.04			
May 26	2	113.5	3.89	1	102.0				
May 27	6	84.5	8.81	2	99.0	5.65			
May 28	3	88.3	12.40	1	105.0				
May 29	1	88.0		7	103.7	4.13			
May 30	3	107.3	5.52	3	116.0	3.30			
June 1	13	94.1	6.20	9	114.1	3.68			
June 2	5	91.4	13.56	3	123.7	4.77			
June 3	2	92.5	22.98						
June 4	2	90.5	20.15	2	110.0	2.83			
June 5	4	110.5	5.88	2	107.5	6.72			
June 6	4	99.5	10.03	2	84.5	1.77			
June 7	5	94.8	8.30	1	132.0				
June 8	4	87.7	11.93						
June 9	2	106.0	12.02	1	92.0				
June 11				2	108.5	3.89			
June 12	7	96.3	6.84	3	99.3	8.69			
June 13	4	101.7	12.34	1	132.0				
June 14	1	64.0							
June 15	1	85.0		1	110.0				
June 16	1	111.0							
June 17	8	87.6	11.83	3	118.7	4.72			
June 18	1	106.0							

Table 13 (cont'd)

Date	*Cottus aleuticus* N	Mean FL (mm)	SE	*Cottus asper* N	Mean FL (mm)	SE	*Cottus* sp.[a] N	Mean FL (mm)	SE
June 19	1	111.0							
June 20	8	98.6	5.87						
June 21									
June 22	1	111.0							
June 23									
June 24	5	106.0	6.26						
June 25									
June 26	9	85.7	5.43						
June 27									
June 28	2	108.0	1.41	1	110.0				
June 29									
June 30	4	66.2	12.92	1	195.0				
Total	367			291			4		
Overall Mean		105.0			114.3			79.7	
Overall SE			1.25			1.06			4.16
Note									

[a]Unspecified cottids

Table 14. Mean wet weights (g), sample sizes and standard errors from cottids at the fence, Lachmach River, 1991.

Date	*Cottus aleuticus*			*Cottus asper*			*Cottus* sp.		
	N	wt. (g)	SE	N	wt. (g)	SE	N	wt. (g)	SE
Apr. 22	1	4.5		10	19.6	3.88			
Apr. 23	1	6.7		5	21.5	2.86			
Apr. 24	3	23.7	2.40	2	17.4	1.92			
Apr. 25	2	15.4	3.66						
Apr. 26	1	8.7		2	21.8	2.88			
Apr. 27	5	9.0	1.08	4	20.2	5.81			
Apr. 28	6	10.8	1.56	6	21.7	1.29			
Apr. 30	6	7.3	2.40	10	23.1	6.17			
May 1	4	16.6	5.34	6	19.8	1.27			
May 2	9	17.2	1.26	10	17.0	1.32			
May 3	44	26.0	2.81	1	11.4				
May 5	11	21.1	4.57	6	10.4	1.61			
May 6	14	22.2	4.35	2	12.7	1.85	1	3.55	
May 9	3	13.9	3.31	5	19.9	2.57			
May 10	2	31.6	14.11	3	21.8	2.97			
May 11	7	7.9	1.87	15	17.3	1.96			
May 12	14	17.7	1.85	10	18.6	3.02			
May 14	11	14.9	1.56	10	14.1	1.44			
May 15	7	14.9	0.96	7	15.7	4.13			
May 16	11	19.3	1.55	8	18.2	2.21			
May 17	1	18.7		6	14.9	3.16			
May 19	6	4.7	1.13	15	21.9	4.94			
May 20	4	16.5	3.93	16	17.4	1.07			
May 21	1	10.7		14	15.1	1.50			
May 23	2	12.2	2.63	1	16.3				
May 30	3	12.7	1.70	3	17.7	1.46			
June 1	12	9.4	1.87	9	17.4	2.27			
June 2	5	11.1	4.89	3	18.7	2.57			

Table 14 (cont'd)

Date	Cottus aleuticus N	Cottus aleuticus wt. (g)	Cottus aleuticus SE	Cottus asper N	Cottus asper wt. (g)	Cottus asper SE	Cottus sp. N	Cottus sp. wt. (g)	Cottus sp. SE
June 3	2	10.5	6.15						
June 4	2	11.1	6.26	2	14.0	0.95			
June 5	4	15.6	2.43	2	13.4	3.57			
June 6	4	12.3	3.52	2	5.9	0.81			
June 7	5	10.2	2.96	1	24.6				
June 8	4	9.6	3.57						
June 9	2	14.1	4.38	1	7.9				
June 11				2	14.8	0.42			
June 12	7	10.0	1.82	3	11.1	2.88			
June 13	4	13.1	3.60	1	24.0				
June 14	1	2.7							
June 15	1	5.6		1	17.8				
June 16	1	13.7							
June 17	8	10.6	1.83	3	22.6	2.72			
June 18	1	11.4							
June 20	8	10.8	2.26						
June 22	1	14.5							
June 24	5	13.6	2.56						
June 26	9	7.9	1.52						
June 28	2	16.5	4.07	1	20.1				
June 30	3	5.8	3.45	1	101.6				
Total	270			209			1		
Overall Mean		15.7			18.2			3.5	
Overall SE			12.28			11.27			

Table 15. Mean wet weights (g), sample sizes and standard errors from salmonids other than coho at the fence, Lachmach River, 1991.

Date	Rainbow Trout N	Rainbow Trout wt. (g)	Rainbow Trout SE	Dolly Varden N	Dolly Varden wt. (g)	Dolly Varden SE	Cutthroat Trout N	Cutthroat Trout wt. (g)	Cutthroat Trout SE
Apr. 22	1	27.1		9	112.8	7.51			
Apr. 23				15	105.9	4.81			
Apr. 24	1	4.5		4	81.5	22.73			
Apr. 25				9	105.0	4.65			
Apr. 26				1	108.5				
Apr. 27	3	6.6	2.53	1	122.2				
Apr. 28				2	72.5	4.72			
Apr. 29				1	5.2				
May 1	2	24.8	0.05	5	103.1	4.44			
May 2				13	75.4	9.23			
May 3				6	83.1	10.24			
May 4	1	24.1		3	22.8	4.77	1	3.1	
May 5	4	20.0	10.22	8	63.3	12.54			
May 6	2	12.2	7.53	8	38.0	8.38			
May 8	2	35.0	4.83	10	36.1	10.10			
May 9	1	2.1		7	18.8	5.65			
May 10	1	14.7		8	16.9	2.98			
May 11				26	44.7				
May 12				1	50.5				
May 14	1	29.9		15	25.2	5.46			
May 15	1	23.6		7	20.0	5.49			
May 16	2	34.8	4.42	8	22.1	8.68			
May 17				24	25.8	4.34			
May 18	1	19.2							
May 19	2	17.8	5.29	31	35.1	5.57			
May 20	6	23.9	3.65	19	19.8	3.74			
May 21	3	24.1	1.59	17	17.3	1.52			

Table 15 (cont'd)

Date	Rainbow Trout N	Rainbow Trout wt. (g)	Rainbow Trout SE	Dolly Varden N	Dolly Varden wt. (g)	Dolly Varden SE	Cutthroat Trout N	Cutthroat Trout wt. (g)	Cutthroat Trout SE
May 22	3	36.2	10.89	23	17.7	1.44			
May 23	5	28.3	6.74	21	26.5	3.99			
May 24	12	37.4	5.00	38	28.9	3.02			
May 26	12	29.5	6.24	62	24.1	1.97			
May 27	5	15.2	3.56	18	19.9	3.41			
May 28	7	22.8	3.96	40	16.8	0.65			
May 29	12	39.1	1.93	35	20.0	2.95			
May 30	20	34.8	4.79	30	20.4	3.59			
June 1	32	28.6	2.24	48	20.1	1.58			
June 2	11	35.5	3.98	32	21.6	2.55			
June 3	35	33.7	1.80	68	18.4	1.29	1	26.2	
June 4	69	33.9	1.35	136	20.1	0.74			
June 5	40	35.2	1.63	9	19.5	1.48			
June 6	41	31.1	1.70	33	18.3	0.79			
June 7	54	32.0	1.56	54	21.5	2.46			
June 8	24	29.0	1.85	6	18.0	2.44			
June 9	46	27.7	1.49	9	22.5	4.55			
June 11	2	34.6	1.98	1	19.7				
June 12	9	19.5	4.95						
June 13	38	28.0	1.74	1	15.9				
June 14	25	26.4	2.02	2	54.4	17.97			
June 15	26	27.5	1.97	1	8.5				
June 16	19	27.5	1.82	2	21.2	1.10			
June 17	19	33.8	2.82	2	17.7	3.25			
June 18	13	15.8	2.66						
June 19	7	22.1	4.81						
June 20	38	18.1	1.99						
June 21	13	19.0	2.69						
June 22	53	21.9	1.36	1	25.4				

Table 15 (cont'd)

Date	Rainbow Trout N	Rainbow Trout wt. (g)	Rainbow Trout SE	Dolly Varden N	Dolly Varden wt. (g)	Dolly Varden SE	Cutthroat Trout N	Cutthroat Trout wt. (g)	Cutthroat Trout SE
June 23	2	30.4	5.97						
June 24	7	18.8	4.46	2	8.2	0.95			
June 25	14	17.4	2.65						
June 26	7	23.0	5.75						
June 28	11	15.2	2.12	4	11.6	2.62			
June 29	4	18.2	2.31						
June 30	10	11.2	1.22	2	5.4	0.07			
Total	779			938			2		
Overall mean		27.8			27.9			14.7	
Overall SE			0.47			0.86			8.14

Table 16. Daily captures of fish at the lower inclined plane trap on the Lachmach River, 1991. Coho fry captured are listed in Table 9.

	Smolts	Pink Fry	Chum Fry	Rainbow Trout	Dolly Varden	Cottus asper	Cottus aleuticus
Apr. 18	0	186	0	1	0	4	0
Apr. 19	2	250	0	2	0	0	0
Apr. 20	1	122	0	0	0	1	0
Apr. 21	2	250	0	0	0	1	0
Apr. 22	0	293	0	0	0	1	0
Apr. 23	2	274	0	0	0	1	0
Apr. 24	0	39	0	0	0	0	0
Apr. 25	0	0	0	0	0	0	0
Apr. 26	0	34	0	0	0	0	0
Apr. 27	0	33	0	0	0	2	0
Apr. 28	4	241	0	0	0	2	0
Apr. 29	0	126	0	0	0	1	0
Apr. 30	1	281	0	0	0	1	0
May 1	2	178	0	0	0	1	0
May 2	8	70	0	1	0	0	0
May 3	7	87	0	0	0	0	0
May 4	3	9	0	0	0	0	0
May 6	5	0	0	0	0	0	0
May 7	35	27	0	0	1	0	0
May 9	12	31	0	0	2	1	2
May 11	33	141	0	0	0	1	0
May 13	78	6	0	0	0	0	0
May 14	98	0	0	0	1	1	0
May 15	14	9	0	0	0	0	0
May 16	8	0	0	0	0	3	0
May 17	36	38	0	0	1	0	0
May 18	60	4	0	0	0	2	0
May 19	97	0	0	0	0	1	0
May 20	72	8	0	0	2	3	0

Table 16 (cont'd)

Date	Coho Smolts	Pink Fry	Chum Fry	Rainbow Trout	Dolly Varden	Cottus asper	Cottus aleuticus
May 21	63	0	0	0	0	1	0
May 22	34	6	0	0	0	0	0
May 23	49	0	0	0	1	0	0
May 24	23	7	0	0	0	0	0
May 25	17	0	0	0	0	3	0
May 26	81	0	0	1	0	0	0
May 27	25	1	0	0	0	0	0
May 28	9	0	0	0	0	0	0
May 29	8	7	0	1	0	0	0
May 30	30	0	0	0	0	0	0
June 1	30	3	0	0	0	0	0
June 2	13	0	0	2	2	0	0
June 3	3	0	0	0	0	0	1
June 4	1	0	0	0	0	1	0
June 5	0	0	0	0	0	0	0
June 6	1	0	0	1	0	1	0
June 7	0	0	0	0	0	0	0
June 8	1	0	0	0	0	0	0
June 9	0	2	0	0	0	0	0
June 10	0	0	0	0	0	0	0
June 11	1	0	0	0	0	0	0
June 12	0	0	0	0	0	0	0
June 13	0	0	0	0	0	0	0
June 14	2	0	0	0	0	0	0
June 15	1	0	0	0	0	0	0
June 16	0	0	1	0	0	0	0
June 17	0	0	0	1	0	0	1
June 18	1	0	0	0	0	0	3
June 19	2	0	0	0	0	0	0

Table 16 (cont'd)

Date	Coho Smolts	Pink Fry	Chum Fry	Rainbow Trout	Dolly Varden	*Cottus asper*	*Cottus aleuticus*
June 20	1	0	0	1	0	0	0
June 21	0	0	0	0	0	0	0
June 22	0	0	0	1	0	0	0
June 23	0	0	0	0	0	0	0
June 24	0	0	0	2	0	0	0
July 1 to July 3	not fishing due to high water						
July 4	0	0	0	1	0	3	1
Totals	980	2,763	1	15	10	36	8

Table 17. Daily captures of fish at the upper inclined plane trap on the Lachmach River, 1991. Coho fry captured are listed in Table 9.

Date	Coho Smolts	Pink Fry	Chum Fry	Rainbow Trout	Dolly Varden	*Cottus asper*	*Cottus aleuticus*
Apr. 26	3	52	0	0	0	0	1
Apr. 27	0	212	0	0	0	0	0
Apr. 28	2	148	0	0	0	3	0
Apr. 29	5	29	0	0	0	2	1
Apr. 30	4	0	0	0	0	2	0
May 1	4	0	0	0	0	3	0
May 2	1	19	0	0	0	3	0
May 3	14	238	0	0	0	2	0
May 4	8	0	0	0	0	1	5
May 6	13	0	0	0	0	1	1
May 7	16	0	0	1	0	2	1
May 9	17	0	0	0	0	0	2
May 11	49	66	0	0	0	0	0
May 13	111	0	0	0	4	0	1
May 14	98	0	0	0	0	2	0
May 15	30	0	0	0	2	2	3
May 16	33	0	0	0	1	2	0
May 17	48	0	0	0	2	0	1
May 18	110	7	0	0	1	0	0
May 19	78	2	0	0	3	2	2
May 20	139	0	0	0	1	1	2
May 21	102	1	0	0	0	0	0
May 22	61	0	0	0	0	1	0
May 23	26	0	0	0	0	0	0
May 24	20	1	0	0	0	0	2
May 25	93	0	0	0	1	1	2
May 26	99	0	0	0	0	1	0
May 27	35	1	0	0	1	0	3

Table 17 (cont'd)

Date	Coho Smolts	Pink Fry	Chum Fry	Rainbow Trout	Dolly Varden	Cottus asper	Cottus aleuticus
May 28	21	0	0	0	0	0	0
May 29	33	0	0	0	0	1	0
May 30	40	0	0	0	1	1	0
June 1	35	0	0	0	0	0	0
June 2	21	0	0	1	3	0	0
June 3	10	0	0	0	0	0	1
June 4	6	0	0	0	0	1	0
June 5	5	0	0	0	0	0	0
June 6	3	0	0	0	0	0	0
June 7	1	0	0	0	0	0	0
June 8	7	0	0	0	0	1	1
June 9	0	0	0	0	0	0	0
June 11	1	0	0	0	0	0	0
June 12	2	0	0	0	0	0	0
June 13	3	0	0	1	1	0	0
June 14	0	0	0	0	0	0	2
June 15	0	0	0	0	0	0	0
June 16	0	0	2	0	0	0	0
June 17	0	0	2	0	0	0	0
June 20	2	0	0	2	0	1	0
June 22	1	0	1	1	0	0	0
June 23	1	0	0	0	0	0	1
June 24	0	0	0	1	0	0	0
June 29	1	0	0	0	0	1	0
June 30	1	0	0	1	0	0	1
July 1 to July 4	not fishing due to high water						
July 5	2	0	0	0	0	0	0
July 9	0	0	0	20 fry	0	0	0
July 11	0	0	0	7 fry	0	0	0
July 12	0	0	0	16 fry	0	0	0

Table 17 (cont'd)

Date	Coho Smolts	Pink Fry	Chum Fry	Rainbow Trout	Dolly Varden	*Cottus asper*	*Cottus aleuticus*
July 13	0	0	0	24 fry	0	0	0
Totals	1,415	776	5	75	21	37	33

Table 18. Summary of coho smolt sampling data from the upper and lower inclined plane traps on the Lachmach River, 1991. Data are from fish larger than 55 millimetres.

Date	Lower IPT Fork Length (mm)			Upper IPT Fork Length (mm)		
	N	Mean	SE	N	Mean	SE
Apr. 19	2	82.0	2.83			
Apr. 20	1	79.0				
Apr. 21	2	90.5	6.72			
Apr. 23	2	79.0	4.24			
Apr. 28	4	83.7	5.44	2	95.5	13.79
Apr. 30	1	71.0		3	90.7	2.60
May 1	2	88.0	7.79	4	91.2	3.64
May 2	8	93.7	3.00	1	104.0	
May 3	7	85.3	3.72	14	90.2	2.69
May 4	3	94.0	6.23	8	95.1	2.70
May 6	5	90.4	4.15	13	89.7	2.55
May 7	35	95.6	1.42	16	91.1	2.64
May 9	12	88.5	2.60	17	88.7	2.35
May 11	33	94.0	1.45	49	95.6	1.60
May 13	78	96.0	1.36	56	94.4	1.61
May 14	56	94.3	1.42	56	92.5	1.74
May 15	14	90.0	2.90			
May 16	8	102.5	6.29	33	94.6	2.50
May 17	36	95.8	1.86	48	98.8	1.80
May 18	55	96.1	1.64	56	98.4	1.59
May 19	54	98.5	1.37	54	96.1	1.83
May 20	54	94.6	1.52	54	95.3	1.36
May 21	63	94.1	1.67	54	98.0	1.67
May 22	34	96.4	1.91	61	95.6	1.41
May 23	49	95.0	1.63	26	92.0	1.81
May 24	23	92.6	2.08	20	96.8	2.13
May 25	17	93.6	2.62	54	94.5	1.46

Table 18 (cont'd)

Date	Lower IPT Fork Length (mm) N	Mean	SE	Upper IPT Fork Length (mm) N	Mean	SE
May 26	78	95.4	1.24	54	92.4	1.69
May 27	25	92.9	2.26	35	90.5	1.94
May 28	9	100.9	2.28	21	89.4	1.41
May 29	8	98.0	3.23	33	89.2	1.47
May 30	30	96.1	2.23	40	87.4	1.05
June 1	30	86.9	0.95	35	89.0	1.42
June 2	13	86.1	2.15	21	95.0	2.39
June 3	3	85.0	8.73	10	89.8	2.55
June 4	1	93.0		6	90.8	3.45
June 5				5	89.6	2.58
June 6	1	90.0		3	81.0	2.35
June 8	1	80.0		7	82.7	4.71
June 11	1	78.0		1	84.0	
June 12				2	86.5	0.35
June 13				3	97.3	6.44
June 14	2	77.0	5.66			
June 15	1	72.0				
June 18	1	67.0		1	67.0	
June 19	2	74.0	2.12			
June 20	1	63.0		2	70.5	0.35
June 22				1	92.0	
June 23				1	77.0	
June 29				1	65.0	
June 30				1	75.0	
July 5				1	66.0	
Totals	865			992		
Means		94.2			93.6	
Overall SE			0.38			0.37

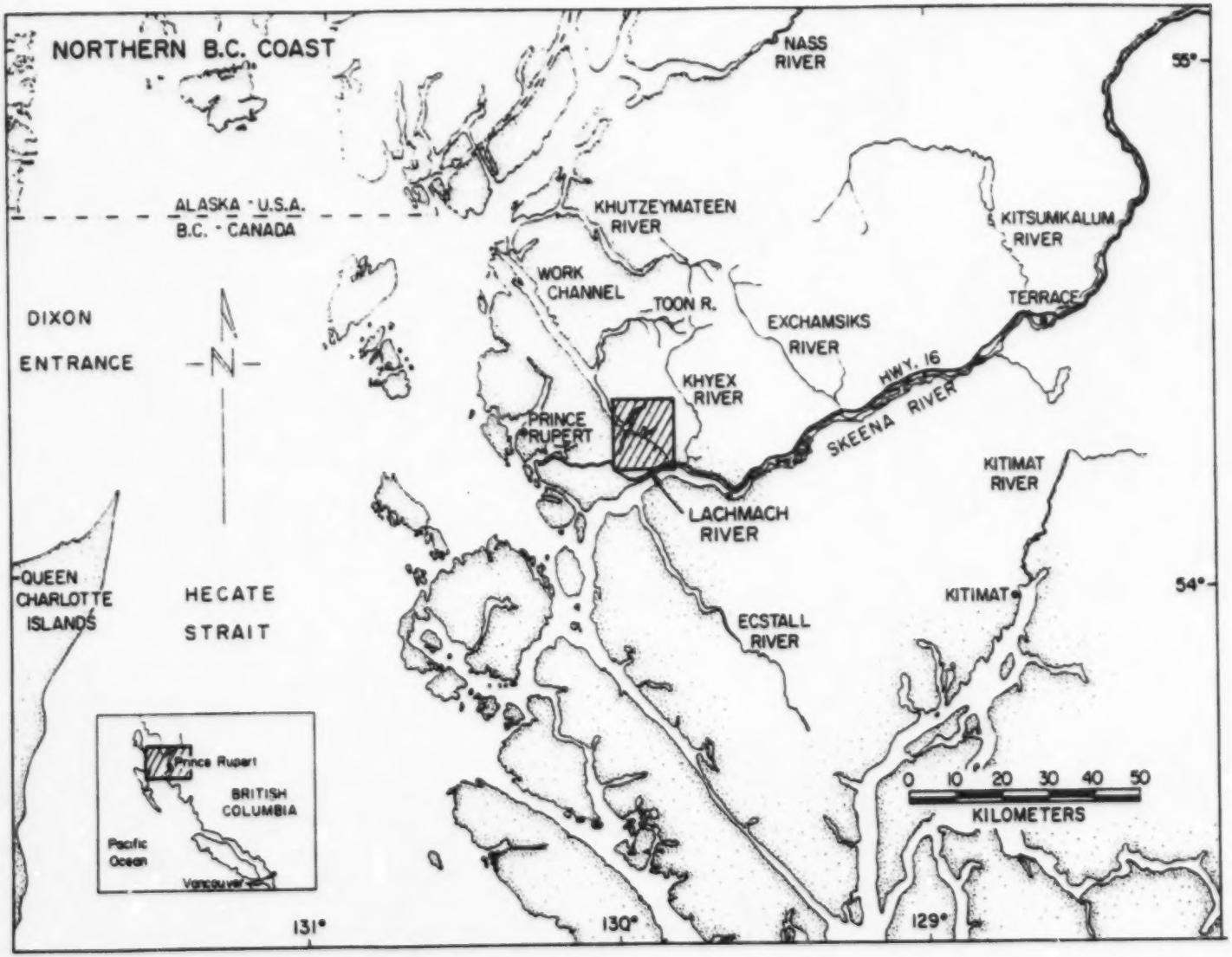

Figure 1. Regional map of the Prince Rupert area showing location of Work Channel and the Lachmach River.

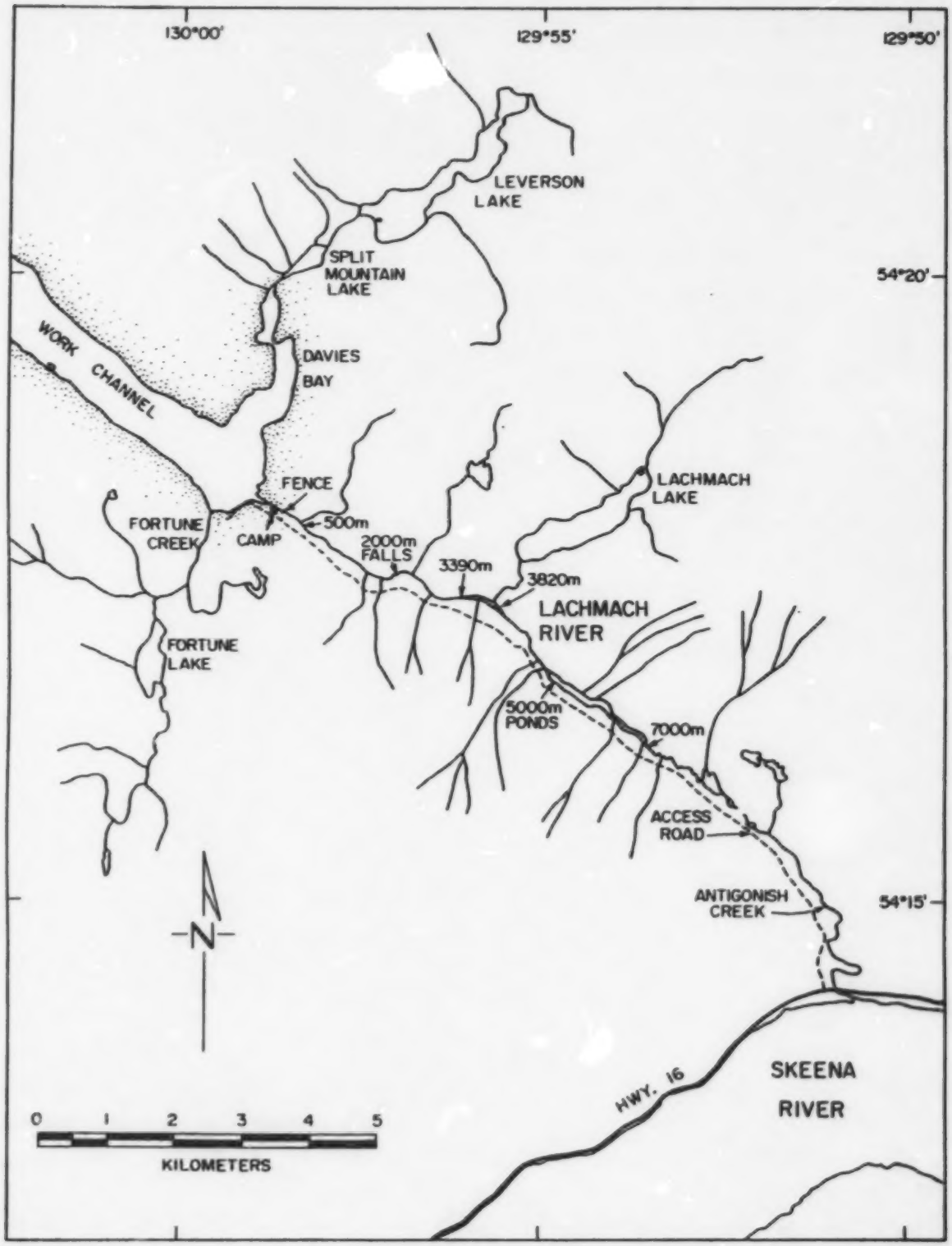

Figure 2. Map of the Lachmach River showing locations of study sites and adjacent systems.

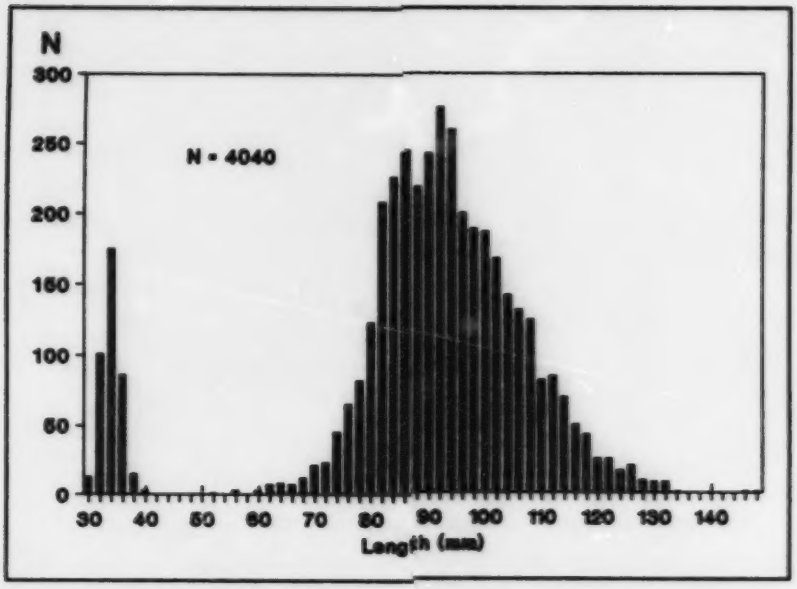

Figure 3. Length frequency of juvenile coho from the Lachmach River fence, 1991.

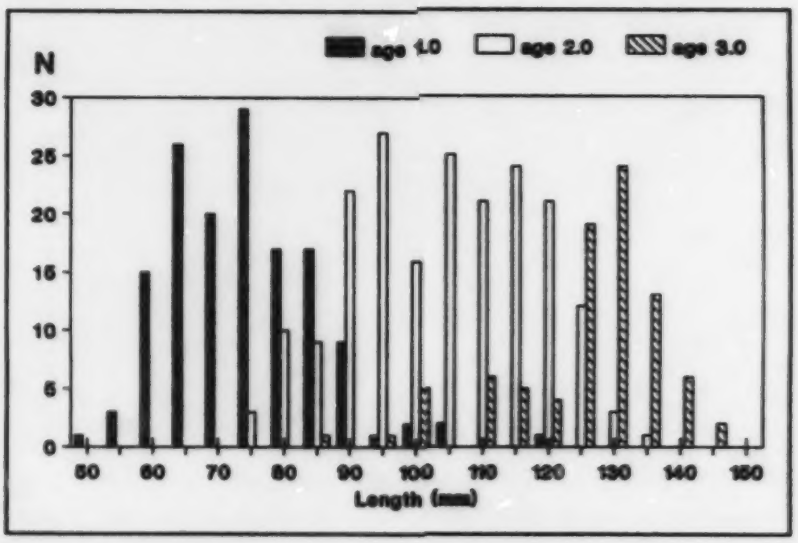

Figure 4. Length frequency of coho smolts by age from the Lachmach River fence, 1991.

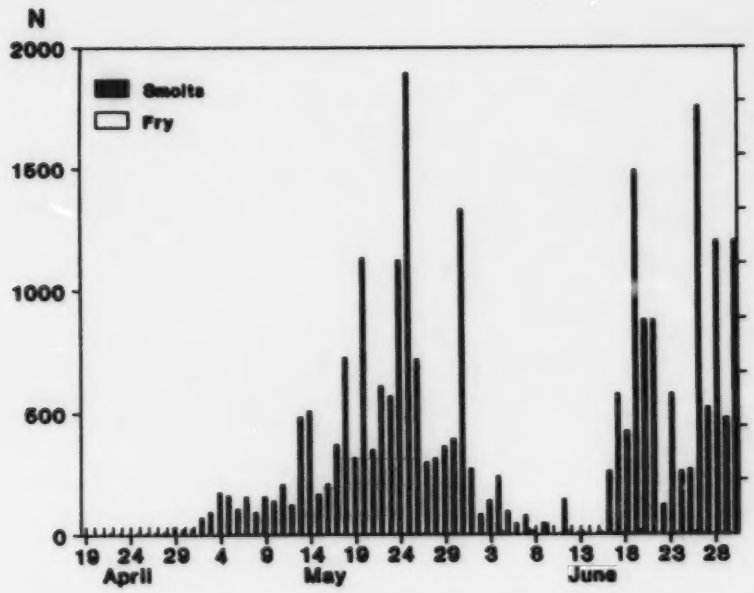

Figure 5. Daily captures of coho fry and smolts from the Lachmach River fence, 1991.

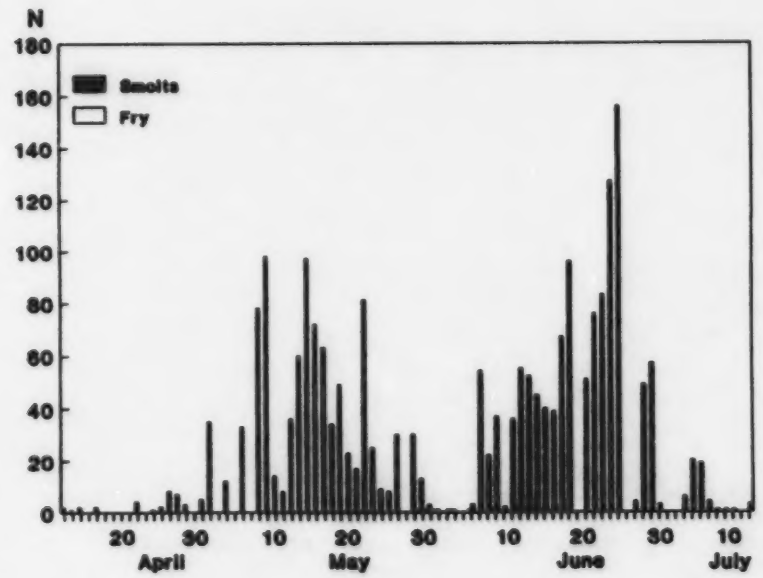

Figure 6. Daily captures of coho fry and smolts from the lower inclined plane trap in the Lachmach River, 1991.

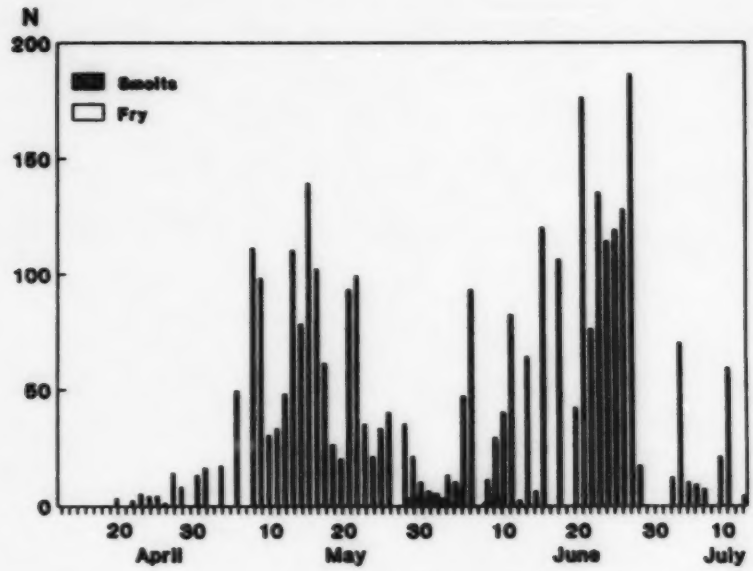

Figure 7. Daily captures of coho fry and smolts from the upper inclined plane trap on the Lachmach River, 1991.

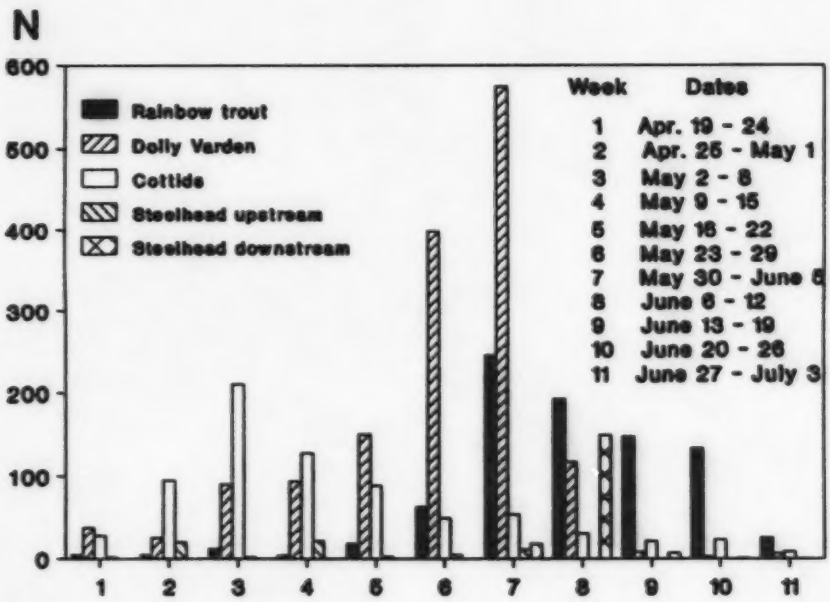

Figure 8. Weekly captures of species other than coho from the Lachmach River fence, 1991.

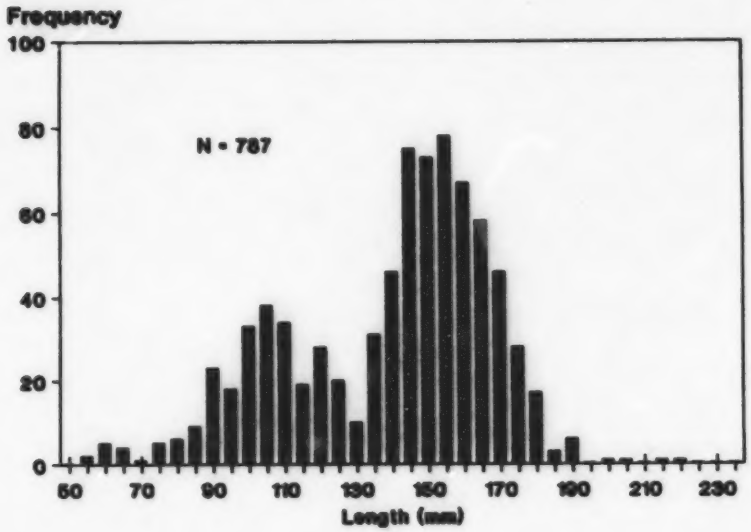

Figure 9. Length-frequencies of rainbow trout from the Lachmach River fence, 1991.

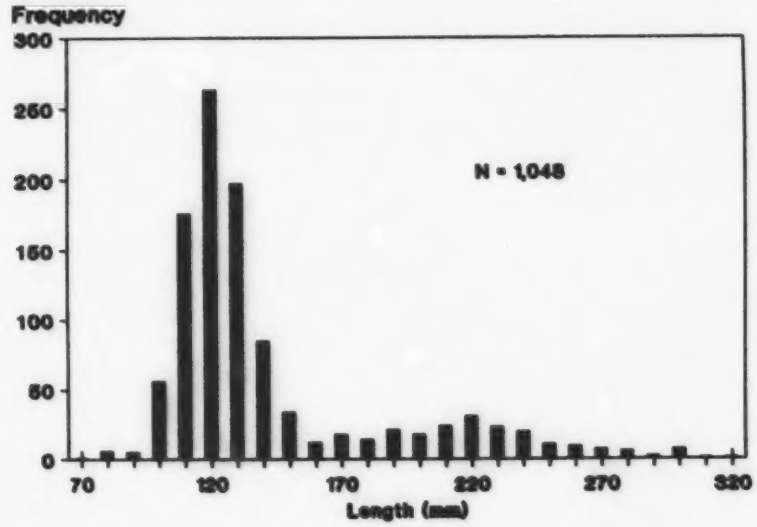

Figure 10. Length-frequencies of Dolly Varden charr from the Lachmach River fence, 1991.

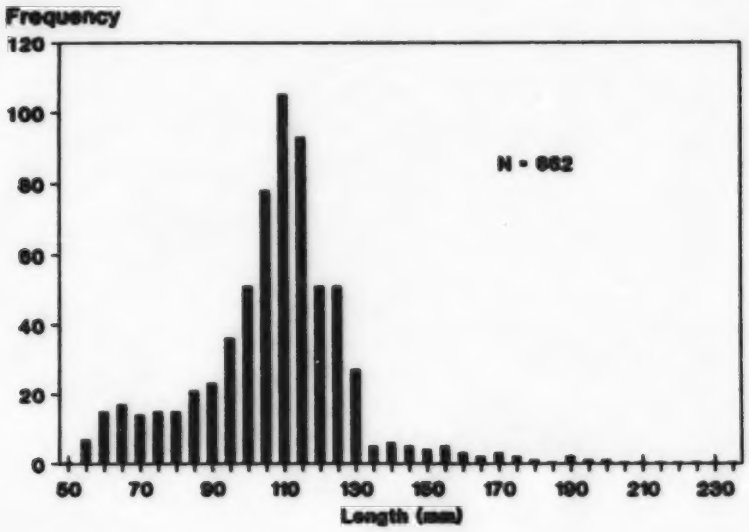

Figure 11. Length-frequencies of sculpins from the Lachmach River fence, 1991.

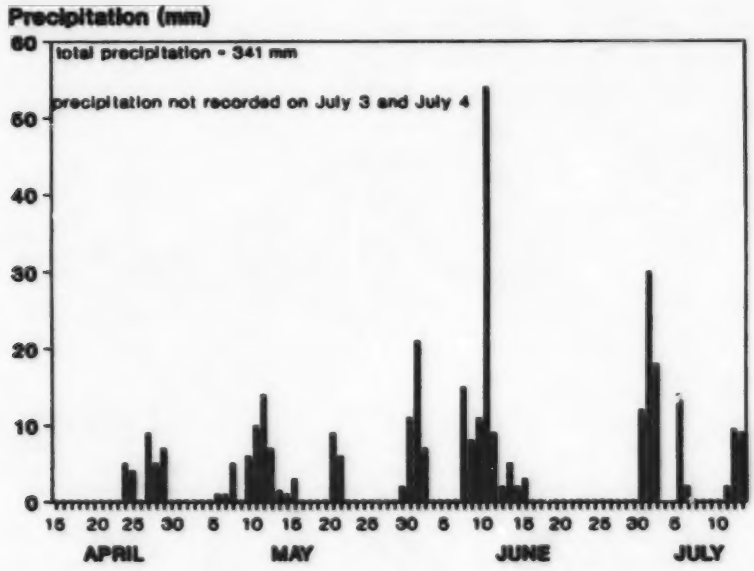

Figure 12. Precipitation at the Lachmach River fence, 1991.

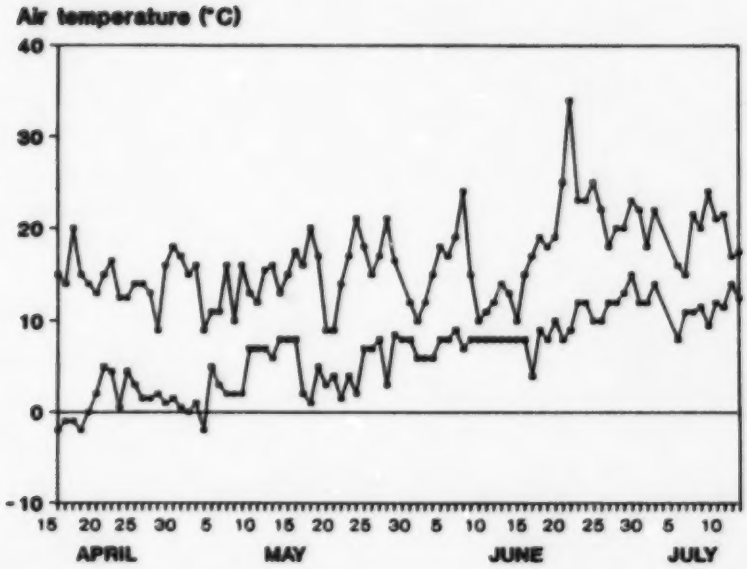

Figure 13. Minimum and maximum air temperatures at the Lachmach River fence, 1991.

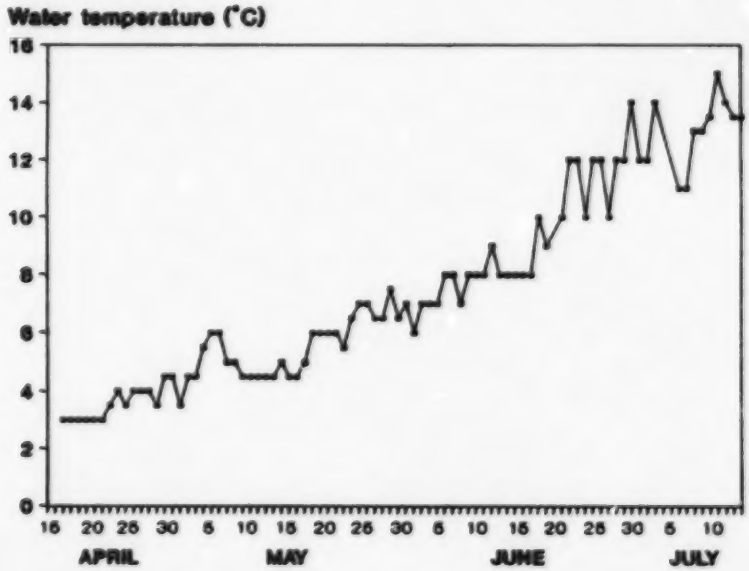

Figure 14. Water temperatures at the Lachmach River fence, 1991.